BEST AVAILABLE COPY

The Coal Situation

B-900-5

VOL. 5 – No. 1
DECEMBER, 1984

THE GLOBAL SHIFT TO LOWER RANK, SURFACE MINEABLE COAL

Introduction

During the course of our travels to coal producing regions of the world, the magnitude of a trend in the coal industry has become very apparent. This trend is the development of, and increasing dependency on, more remote coal fields which, typified by lower grade and simpler geology, result in higher productivity surface mines. High productivity is a necessity since these mines must bear the high capital costs associated with the need for townsites, power, water and rail lines.

This paper is meant to be a very broad review of this trend. Perhaps it is interesting enough for U.S. based readers to fully realize that the domestic shift to more distant, larger sized, surface-mined operations located west of the Mississippi River is *not* a unique occurrence. Similar situations are occurring worldwide. With this trend, the coal industry is facing a new set of critical questions. For instance, what does the opening of these large scale mines do to supply/demand balances as compared to the days of 500,000 tons per year (tpy) operations? How does one finance multi-million dollar rail lines, power lines, towns, etc., unless large production tonnages *can* be sold from the outset? Do governments need to realize that the coal industry requires some financial aid in order to open up these new regions in response to the changes in market location and structure?

What is causing this shift to occur? This paper will show how coal distributions, population densities, technological advances and changes in market structure are causing this trend to be global in scope.

Coal Distributions – Rank vs. Geology

A coal's rank (heat value and volatile matter content) is only partly determined by the type of vegetation material originally accumulated. Of more importance is the later alteration caused by burial depth, maximum temperatures and pressures, and the effects of igneous intrusions. These conditions are provided by *Diastrophism* which is the process of deformation in the earth's crust that produces continents and ocean basins, plateaus and mountains, folds of strata, and faults.

Deformation causes higher rank (bituminous and anthracite) coals to be typically associated with more complex geology and more adverse terrain. Similarly, lower rank coals (sub-bituminous and lignites) tend to be free of disturbance and situated at shallow depths in broad, flat plateaus.

A glance at a world map would show that the majority of mountain ranges are coastal. Continental drift, as caused by a phenomenon termed *plate tectonics*, is responsible for this. In short, the earth's plates separate at ocean ridges and diverge towards the continents. A constant collision occurs; with the lighter continents being crumpled at their edges by compression resulting in the formation of mountains. It is this post-depositional action which provided the forces necessary to create the higher rank coals. It follows that these coals are generally found relatively close to coastlines while the lignites, sub-bituminous, and lower ranked bituminous coals are found inland where post-depositional forces were minimal.

Population Densities

Another glance at a world map, this time one depiciting distribution of population, would show the high density areas to be along coastlines and major waterways. This is obviously to facilitate industry and trade. For reasons just explained, mankind was, unconsciously, also settling near those coal fields of higher rank and more complex geology. Due to this relationship and due to coal's very high transportation cost (caused by its low value to weight ratio), the inherently lower cost reserves of the hinterlands were minimally exploited while the locally available and relatively higher cost to produce reserves were fully developed.

This is certainly not the situation for petroleum or metalliferous ores which (a) have relatively low per unit of value transportation cost components and (b) do not share coal's relationship with geologic conditions and population centers or coastlines.

Technological Advances

One of the most important advances in the coal industry over the past 25 years has been the introduction of large surface mining equipment such as stripping shovels, draglines and off-highway trucks. This has enabled surface mines to recover much deeper coal reserves at low cost prior to reaching breakeven economics with underground operations. Once this point is reached, underground methods need to be utilized in order to limit operating costs as mining progresses deeper. The importance of this relatively new capability has been that the more remote mines can become competitive. The resulting mine operating costs are low enough to provide sufficient margin to allow for the higher transportation costs to the more distant end users. In short, large-sized surface operations utilizing advances in equipment technology have begun to hold an economic advantage over the smaller sized, more complex surface and underground mining operations in the geologically complex coal fields located closer to population centers. The delivered economic attractiveness of more distant reserves was further aided by the depletion of the cheaper to produce reserves within a close proximity to the consumer.

A second technological change has been the advancement of boiler design to permit the reliable combustion of lower grade coals. This has opened up the market for lignite and sub-bituminous coals for use in large scale power plants. The next generation of power plants will no doubt be based on a design which will allow even more variation in coal specifications.

Changes in Market Demand and Structure

Changes in market demand and structure have contributed to the trend towards more distant large scale mining operations in a number of ways.

First, the depletion of the cheapest, of the locally available reserves coincided with growth in the market. The consumer, therefore, has had to go deeper or further for his coal supply.

Second, the location of market demand is changing. In the U.S., there has been a steady westerly and southerly movement in population and industry away from the traditional mining areas. Internationally, because of the increased price of oil,

there has been increased demand for coal imports from more distant sources.

Third, there has been an increase in the demand for coal from the electric utility sector. In contrast to the industrial sector, power plants consume very large quantities of coal at one location. This characteristic, in addition to supporting the development of very large-sized mines, supported the use of more efficient, relatively cheaper methods of transportation, such as unit trains and large tonnage ocean vessels which in part improves the economic attractiveness of more distant coal supplies.

Fourth, there has been the implementation of more stringent sulfur emissions standards forcing the consumer to focus on obtaining the cheapest delivered cost of coal energy which satisfied air quality standards. In the U.S., while low sulfur coals were available in the eastern half of the country, mining and transport costs were not as competitive with the delivered cost of the lower grade, low sulfur content western coal. Thus, U.S. utilities located in the central midwestern states shifted toward the sub-bituminous coal of the Great Plains. The rate of growth of the easterly movement of western U.S. coals in the late 1960's and early 1970's has been greatly reduced as a result of the subsequent passage of legislation requiring the use of best available control technology (stack gas scrubbers) on all new power plants regardless of the sulfur content of the coal. Nevertheless, western coal continues to enjoy the highest rate of growth in the U.S.

Global Scope of the Shift

It is impossible to cover every coal field in this report, but it should be noted that there are very few exceptions to the trend by the coal industry towards the emphasis on more distant, large scale surface mining operations. The following is a brief review of conditions in the largest coal producing countries (U.S.A., China and U.S.S.R.) and in the key coal exporting countries (Australia, Poland, Colombia, Canada and South Africa).

United States of America

Over the last 10 years, annual coal production in the relatively barren western regions of the U.S.A. has increased from some 83 million tonnes to over 250 million tonnes. Over 90% of this is surface mined. Approximately 90% of this region's coal reserves are of sub-bituminous or lignitic grade.

By contrast, the same time period saw eastern production levels remain stable; going from 460 to 455 million tonnes per year. Less than 50% of this is surface mined. Approximately 99% of this region's coal reserves are bituminous or anthracite. The eastern region still contains over 88% of the total number of mines yet produces only 53% of the tonnage. The large western surface mines employ only 5% of U.S. coal miners, yet produce 25% of the total production.

Wyoming's Powder River Basin is a microcosm of this situation. Due to the very low stripping ratios, 70 foot thick seams and flat terrain, the surface mines here are large and enjoy productivities of over 100 tonnes per man shift (tpms). It is currently estimated that, without the requirement for any additional capital, the basin could produce 120MM tpy. Relatively minimal incremental expenditures for equipment could increase this to 180MM tpy. This is compared to its current production of 90MM tpy. The ease of production for the large mines found in this region, often from 15MM to over 20MM tpy each, has provided an overcapacity of coal which could take 10 years or more to use up.

China

Currently China produces approximately 700 million tonnes of coal annually, about 96% of which is from underground mines. Almost half of China's production comes from 90% of the country's 20,000 coal mines which only produce an average of 20,000 tpy each. China's plan for expansion, however, follows the new trend being outlined in this report. Over 50% of the planned expansion of 400MM tpy by the year 2000 will come from new *open pit* operations having annual capacities of between 10MM to 25MM tpy. Many of these new operations are located in more remote areas where over 60% of the investment will be for rail, rolling stock, water and power. The success of these operations will be tied to the ability to get volume up as quickly as possible to carry the high capital costs. This problem is compounded by the plan to use coal exports from some of these projects to repay foreign debt. The supply for export will increase faster than demand.

U.S.S.R.

The same trend in coal mining operations holds true in the third of the "big 3" coal producing nations. Coal resources are vast, although about half are contained in areas remote from industrial centers and in difficult climates.

The Donetsk Basin is the largest coal-producing area in the U.S.S.R., but mining conditions there are deteriorating and expansion of the industry is expected to occur outside of the European centers (Donetsk and Moscow Basin); in the more remote eastern fields which will utilize large, open cast mines.

For instance, the Donetsk Basin has historically produced over 200 million tpy but, although the coal is of excellent bituminous grade and the field is situated close to rail, water and the population centers of the west, coal seams are quite thin. All mining is underground and depths have increased to where the average is now over 500 meters and 35% of production comes from depths greater than 700 meters.

By contrast, the relatively new Kansk-Achinsk field is situated some 2500 km to the east. The coal here is shallow and of gentle dip but much is only of lignite rank. Large open cast mines are planned to produce some 350MM tpy; much of which is to be burned in mine mouth power plants. Even this development would require additional rail and road as well as high-voltage transmission lines to the West.

Other Russian coal fields will require vast amounts of infrastructure with the distance from East Siberia to consumers being between 5,000 km and 6,000 km. Plans are to build mine mouth power plants and transport the electricity and/or to construct local industries in these sparsely populated regions.

To underscore why the U.S.S.R. is also having to follow "the shift" and develop these distant fields, it should be noted that the deep mines of the Donetsk average only 2.1 tons per man shift versus 46.6 tpms for the surface mines of Kansk-Achinsk.

Australia

It is estimated that by 1990 over 75% of Australian steam coal exports will be mined by open cut methods and that over 50% of the mines will each produce a minimum of 3MM tpy.

As in the U.S.A., there has been a new emphasis on large, open-cast mines in the remote areas. In this case, it is the Bowen Basin of Queensland. Although these mines require larger investment for infrastructure, their simpler geology creates the higher productivities required to compensate; as long as production volumes can be sufficiently large.

The more populated state of New South Wales produces 46MM tonnes from 69 underground mines (average of 667,000 tpy per mine) and 21MM tonnes from 19 opencuts (average of 1,100,000 tpy per mine). By comparison, Queensland mines produce 6MM tonnes from 20 underground mines (average of 300,000 tpy per mine) and 41MM tonnes from 28 opencuts (average of 1,460,000 tpy per mine).

Not surprisingly, Queensland productivity averages 21 tonnes per man shift (tmps) versus 14 tpms for New South Wales and only 9.7 tpms for the South Coast field which lies closest to the city of Sydney on the coast.

Poland

Poland is also participating in the worldwide trend in coal mine characteristics. Poland's hard coal deposits are found in three major basins: the Upper Silesia, Lower Silesia and Lublin. The Upper Silesia is by far the most important region containing 93% of the reserve base. Currently, there are 66 underground coal mines of which 61 are in the Upper Silesia. Although the coal is gently dipping and geologically free of disturbance, the depths are posing some problems. In 1970,

75% of all coal was produced from mines within 500 meters of the surface. Today, this figure has decreased to 50%.

Expansion of 14 mines and present construction of 9 new mines (many of which are in the recently developed Lublin Basin) give Poland an excellent hard coal production base. Of perhaps the most importance, is the increase in surface mining of brown coal (or lignite) production. The existing lignite mines will continue to produce 35MM tpy, but new developments are projected to raise production to 58MM tonnes in 1985/6 and 80MM tonnes in 1990. This could have an effect on the international steam coal market as it could make more Polish hard coal available for export.

Colombia

Currently, only 5 million tonnes are produced from over 600 operating mines. These are almost exclusively underground and situated in the central, south, and eastern populated regions of Colombia. By contrast, the new Cerrejon North complex (Exxon and Carbocol) is a perfect example of the new wave of coal developments being addressed by this paper. It is situated in a remote area of Colombia (the sparsely populated department of La Guajira) and is a very large (15MM tpy) surface mine. Furthermore, more than 50% of initial expenditures will be for infrastructure.

Canada

Over 99% of Canada's 6 billion tonnes of recoverable reserves (in-situ reserves are estimated to be 475 billion tonnes) are located in western Canada (British Columbia and Alberta) and more than 80% of this base is recoverable by surface mining methods. Other than for some underground bituminous operations in the far eastern Maritime provinces, other Canadian coal reserves are found in Ontario, Manitoba and Saskatchewan. These are of low lignitic or sub-bituminous quality. As can be expected, the coal quality generally decreases with increasing distance from the mountains. In fact, Ontario (the most populated of the provinces) imports almost all of its coal from the U.S.

Canada's relatively high cost for coal exports is due to (1) the low cost coals of Alberta's Plains region and Saskatchewan being too far from tidewater and too low in heating value (similar to Wyoming, Montana, and North Dakota economics in the U.S.A.) and (2) the mountainous region of Alberta/British Columbia having (a) excellent metallurgical coal quality but with the associated folding, faulting and mountainous terrain which increases mining costs and (b) long rail hauls 1,100 to 1,200 km to the ports. This is despite the Canadian rail system being very efficient and low cost on a per tonne-kilometer basis.

Canada provides an excellent example of the importance of coal reserve location versus industrial centers. Canadian coal production has grown from 15 million tonnes in 1970 to over 40 million tonnes and exports have increased over the same time period from 4 million tonnes to over 15 million tonnes. This has obviously occurred in the western provinces while the population base, and therefore, Canada's steel mills and large scale power generators, are located in the east. For this reason, approximately 16 million tonnes of coal have to be imported from eastern U.S. coal mines.

South Africa

At first glance, South Africa's coal situation with relation to its coastlines and population centers is again similar to that of other countries. Capetown, Port Elizabeth, East London and Durban form a string of large cities along the coast. The coastal mountains provide local fields of high quality coal but with associated difficult mining conditions. For instance, there are 26 collieries in Natal, located only 100 km from the coast, which average 487,000 tonnes per mine per year at productivities of only 3.4 tpms. The 41 mines of the more interior Transvaal and Orange Free State average over 2MM tpy at productivities averaging approximately 10 tpms.

South Africa's success as the low cost coal exporter can be explained to some extent by how it followed the trend to developing its high productivity, lower grade, inland coal fields. The coal industry did not need to initiate the pioneering push to a remote area. Why were there already the industrial centers and population bases inland from the coast? Why are Pretoria and Johannesburg situated where they are? In one word; gold. The development of South Africa's gold fields provided existing infrastructure in the interior. Granted, it took foresight to build the rail line and the port at Richard's Bay. But, the coal mines were able to market to a local consumer as well. Furthermore, the mining houses provided the capital; thus, leaving the mines less dependent on initial large volumes for debt repayment.

This situation will continue. Surface mining will soon account for 35% of South African coal production, with over 55% of production coming from mines greater than 3MM tpy. A list of major new mines and expansions (representing about 100MM tpy) would show individual annual production levels of 3MM to 27MM tpy.

Effects of the Trend

What does this trend to large scale, open cut operations mean to the coal mining industry? The most important effect comes from the high percentage of fixed costs associated with these new mines which requires production levels to be high (typically from 3 to 15 million tpy) in order to maintain a profitable operation.

For instance, investment costs for ten of the more recent coal developments have averaged between $75 and $100 per annual tonne of productive capacity. Typically, however, only 20% to 30% of this amount has been for the actual coal mine. The remainder is required for infrastructure which usually cannot be constructed in stages. This is a particular problem for rail and power lines which are effectively built on an "all or nothing" basis. Thus, these new mines must be based on large design capacities and have little flexibility to hold per tonne operating margins if production must be decreased. Therefore, the development of these mines results in drastic surges in available supply versus the steady (and usually frustratingly slow) increases in demand.

This is the situation for the coal industry today. Whether examining the U.S. domestic or the international markets for coal trade, we find an excess supply situation forcing low prices and greatly reduced profitability in the industry. As a result, little if any new developments are being undertaken. In essence, suppliers are waiting for market demand to catch up with supply leading to improvement in coal mining profitability. The key danger here is that the lag between when the market signals the need for more coal and the time needed for the development of new mines could very well lead to a sharper than required increase in market prices. In responding to this market signal, all producers will be dusting off the prospects which they deferred over the past few years. If development occurs simultaneously as in the recent past, the cycle of excess capacity and falling prices will be repeated. This potential points to the importance for each coal producer to maintain an overall perspective of the competitive attractiveness of the properties he possesses relative to his competition.

This paper has provided numerous examples of, and the reasons behind, the global shift to the development of large, typically surface mined coal projects which have long lead times but high production. This means that the relatively quick shifts in the supply/demand balance that have been witnessed over the past decade will continue to occur. The high capital cost of these new projects (much of which is for "fixed" infrastructure) makes these coal mines extremely dependent on production volume. Mining companies and commercial banks providing debt need to work closely together to ensure that a finance package is reflective of those unique characteristics of the world coal industry.

James M. Griffin
Vice President & Technical Director

Vincent J. Calarco, Jr.
Vice President & Coal Economist

GLOBAL SPECIALIZED INDUSTRIES
David F. Banks, Senior Vice President

•

GLOBAL MINING & METALS DIVISION
DIVISION EXECUTIVE
Edward D. Henderson, Jr., Vice President

•

TECHNICAL STAFF
William A. Mulligan, VP, Senior Technical Director
Coal: James M. Griffin, VP
Aluminum: Jeremy W. Johnson, VP
Coal Economist: Vincent J. Calarco, Jr., VP
Steel: Dr. Lindsay D. Norman, Jr.
Stefan Ponto, AA

UNITED STATES
Mining & Metals Division
1 Chase Manhattan Plaza – 3
New York, NY 10081
TELEX: ITT 420650 CMB UI

NON-FERROUS METALS
Clare E. Bruder, VP, Team Leader
Arthur F. Casavant, III, 2VP
Eric Van Heyst, 2VP
Helene Santo, AT
Loretta Fava, AA
Mary Leone, AA

STEEL
Eugene A. Berry, VP, Team Leader
Brian E. Crowley, 2VP
Thomas C. Gardner, 2VP
Gregory C. Clapp, DR
Gary R. Kaneb, DR
Stephen R. Simon, AA

ALUMINUM
A. Neil Sweeny, VP, Team Leader
Peggy Peckham, VP
Efrain Figueroa, AA

COAL
Guy C. Heckman, VP, Team Leader
Michael A. Cacouris, AT
Peter J. Foley, DR
Kenneth E. Johnson, AA

LATIN AMERICAN BUSINESS COORDINATOR
C. Becton Ford, VP

CUSTOMER SERVICE & OFFICE ADMINISTRATION
Patricia A. Furman, 2VP
Judith Amato Staaby, AT

FINANCIAL MANAGEMENT
Joseph A. Franzese, AT
Betty Ann P. Locke, AA

AFRICA
CHASE MANHATTAN OVERSEAS CORP.
Rep. Off. POB 9606
P.O. Box 9606 Johannesburg 2000
Johannesburg, South Africa
TELEX: JHB-7774

Henry E. Coe, VP, Africa Coordinator

KENYA, ZAMBIA, ZIMBABWE
CHASE MANHATTAN OVERSEAS CORP.
East Africa Regional Office
P.O. Box 57051 Kencom House
Nairobi, Kenya
TELEX: 22722 NAIROBI

Robert John Fairall, Regional Manager

ASIA-PACIFIC

AUSTRALIA
CHASE MANHATTAN REGIONAL OFFICE-Australasia
15 National Bank Hse, 500 Bourke St.
Melbourne 3000, Australia
TELEX: C/CHASNAT AA33950

Peter W. Mills, VP, Asia Pacific Coordinator

INDONESIA
THE CHASE MANHATTAN BANK, N.A.
G.P.O. Box 311
Jalan Medan Merdeka Barat 6,
Jakarata, Indonesia
TELEX: 44281-44369 (Chase JKT)

Jeroen J. Zweerts, VP

JAPAN
THE CHASE MANHATTAN BANK, N.A.
CPO 383 Tokyo 100-91
1-3 Marunouchi 1-Chrome, Chiyoda-Ku
Tokyo 100, Japan
TELEX: 22294 CHAMANBK J22294

Hideya Katayama, VP

KOREA
THE CHASE MANHATTAN BANK, N.A.
C.P.O. Box 2249
50, 1-KA, Ulchiro, Choong-Ku
Seoul 100, Korea
TELEX: CHASBK K23249

N.S. Kang, VP

MALAYSIA
THE CHASE MANHATTAN BANK, N.A.
Wisma Stephens
88 Jalan Raja Chulan
Kuala Lumpur, 05-12 Malaysia
TELEX: MA 30224

Tang Kok Yew, VP

PHILIPPINES
THE CHASE MANHATTAN BANK, N.A.
OFFSHORE BANKING UNIT
18 Fl., Filinvest Financial Center
Paseo de Roxas, Makati, Manila
TELEX: RCA 22696 CMB PH

Augusto Nilo, VP

TAIWAN
THE CHASE MANHATTAN BANK, N.A.
72 Nanking East Road Section 2
Taipei, Tiawan
TELEX: 21823 CHAMANBK

Rodney Freed, VP

THAILAND
THE CHASE MANHATTAN BANK, N.A.
Siam Center 965 Rama 1 Road
Bangkok, Thailand
TELEX: CHAMANBK TH 2601

Piyaburtra Vasudhara, VP, Mgr.

EUROPE

FRANCE
THE CHASE MANHATTAN S.A.
39 Rue Cambon
75001 Paris, France
TELEX: 210610 CHASB

James G. Murray, VP

GERMANY
CHASE BANK A.G. HEADQUARTERS
Frankfurt/Main
P.O. Box 4428 Taunusanlage 11
Frankfurt/Main, Germany 6000
TELEX: 411625 CHAS D

Martin J. Hecke, VP

ITALY
THE CHASE MANHATTAN BANK, N.A.
P.O. Box 10285 PT EUR
00100 Rome, Italy
TELEX: 610501 CHASER I

Michele Vitali, 2VP AM

SWEDEN
CHASE MANHATTAN OVERSEAS CORP.
Biblioteksgatan 11
Stockholm, Sweden 11146
TELEX: 12343 CHAMAN S

Gunnar M. Carlsson, VP

UNITED KINGDOM
THE CHASE MANHATTAN BANK, N.A.
P.O. Box 440
Woolgate House, Coleman Street
London EC2P 2HD, England
TELEX: 8954681 CHAMANBANK LDN

Robert T. Hinaman, VP

WESTERN HEMISPHERE

ARGENTINA
THE CHASE MANHATTAN BANK, N.A.
25 De Mayo 130/140
Buenos Aires, Argentina
TELEX: 9138/9

Cesar A. Deymonnaz, 2VP

BRAZIL
CHASE/BANCO LAR
Praia De Botafogo 374
Rio De Janeiro, Brazil 22250
TELEX: (021) 31.647-31.692-BLAR-BR

Juan Carlos Del Rosario, VP
James Lynch

CANADA
CHASE MANHATTAN CANADA LIMITED
3605 Commerce Court West
P.O. Box 302-Commerce Ct. Postal Sta.
Toronto, Ontario, Canada M5L 1G1
TELEX: 06-23622

Clemens Wedel, VP
Gary R. Baumer, VP

CHILE
THE CHASE MANHATTAN BANK, N.A.
Mac Iver 325 Piso 6
Casilla De Correos
Santiago, Chile
TELEX: 1327 CHASE CZ

Alejandro G. Silva, 2VP

COLOMBIA
THE CHASE MANHATTAN BANK, N.A.
Apartado Aereo 16192
Edif Seguros Fenix CA7#32-33 Piso 29
Bogata, Colombia
TELEX: 44572 CHASE BOG

Manuel C. Pena-Morros, Country Manager

MEXICO
THE CHASE MANHATTAN BANK, N.A.
Apartado 37-477
300 Paseo De La Reforma Piso 7
Mexico 6D.F., Mexico
TELEX: 01771370 CHAMANBANK

Raul A. Chavez, VP
David Mills Smelser, AT

PERU
CHASE MANHATTAN OVERSEAS CORP.
Representative Office
Ricardo Rivera Navarrete 543
San Isidora, Lima, Peru
TELEX: 2569C PE CHAMANRU

Jorge E. Sosa, 2VP

VENEZUELA
THE CHASE MANHATTAN BANK, N.A.
Apartado 6559
Torre Phelps, Piso 26, Plaza Venezuela
Caracas 1010-A, Venezuela
TELEX: 21422 CHASMAN

Guillermo A. Montefusco, 2VP

The Coal Situation

B1500-5A

VOLUME 5 – NO. 2
MARCH 1985

INTERNATIONAL COAL TRADE – 1985

A record 304.7 million metric tons (tonnes) of coal were traded internationally in 1984, 38.7 million tonnes (14.5 percent) greater than 1983. This total volume of trade consisted of 155.8 million tonnes of metallurgical (coking) coal and 148.9 million tonnes of thermal (steam) coal. These are both record levels in-and-by themselves and represent respective increases of 20.5 million tonnes (14.8 percent) and 18.2 million tonnes (13.9 percent) over 1983.

The purpose of this issue of *The Coal Situation* is to review the results and the factors which influenced trade in 1984, and to provide our outlook for trade flows in 1985.

Review of 1984

In 1984, increased takes by all importing regions resulted in record levels of trade in both the metallurgical and thermal coal segments of the market. As shown in Table 1, world metallurgical coal imports grew by 20.5 million tonnes over 1983 trade levels, while thermal coal trade increased by 18.2 million tonnes.

On a regional basis, the European Economic Community (EEC) and Japan accounted for 81.5 percent (16.7 million tonnes) of the increase in 1984 metallurgical coal imports. Together, these two areas accounted for 65.3 percent of the 155.8 million tonnes of metallurgical coal which moved internationally.

The EEC also registered the largest volumetric increase in the thermal coal segment in 1984. The Community's 9.8 million tonnes of additional imports represented almost 54 percent of the total increase in thermal coal trade for the year. Volumetrically, the remaining 8.4 million tonnes of expansion were relatively evenly distributed among North America (Canada), Japan, and the Other Asia regions, with relatively minor growth registered in the Latin American and "Others" markets.

TABLE 1
WORLD HARD COAL IMPORTS 1984 VERSUS 1983
(Million Metric Tons)

	Metallurgical Coal			Thermal Coal			Total		
	1983 (R)	1984 (P)	% Change	1983 (R)	1984 (P)	% Change	1983 (R)	1984 (P)	% Change
North America	6.3	7.0	11.1	10.4	12.7	22.1	16.7	19.7	18.0
Latin America	7.3	9.3	27.4	0.2	0.4	100.0	7.5	9.7	29.3
EEC	25.4	32.5	27.9	51.5	61.3	19.0	76.9	93.8	22.0
Other W. Europe	11.9	12.0	0.8	10.7	10.8	0.9	22.6	22.8	0.9
Eastern Europe	11.1	11.3	1.8	24.0	24.0	0.0	35.1	35.3	0.6
Japan	59.7	69.3	16.1	15.5	18.5	19.4	75.2	87.8	16.8
Other Asia	10.3	10.9	5.8	13.8	16.1	16.7	24.1	27.0	12.0
Others	3.3	3.5	6.1	4.6	5.1	10.9	7.9	8.6	8.9
Total	135.3	155.8	15.2	130.7	148.9	13.9	266.0	304.7	14.5
Seaborne*	112.0	131.6	17.5	87.6	103.6	18.3	199.6	235.2	17.8

* Excluding overland, barge and lake deliveries
(R) Revised
(P) Preliminary

BEST AVAILABLE COPY

Table 2 shows the country detail for the EEC's hard coal imports from third-party countries. The Community's third party imports represent imports from nations which are not members of the EEC. The difference between the import volumes shown in Table 2 and the Community's total imports (Table 1) represents trade between Community members, the majority of which is supplied by the Federal Republic of Germany and the United Kingdom.

As shown in Table 2, Germany, Luxembourg, Ireland and Greece contributed little volumetrically to the dramatic increase in the EEC imports from third-party countries in 1984. The remaining six countries, however, registered increases of two million tonnes or more over their 1983 import levels. The largest volumetric increase in EEC imports was registered by France with its 16.68 million tonnes of total third-party imports being 3.8 million tonnes greater than 1983. The United Kingdom, however, was not very far behind with its third-party imports increasing by 97.3 percent or 3.6 million tonnes in 1984, a result of the extended strike experienced at its domestic mines.

TABLE 2

EEC HARD COAL IMPORTS FROM THIRD PARTY COUNTRIES

(Million Metric Tons)

				Percent Change	
	1982	1983	1984	1983/82	1984/83
Germany	8.81	7.94	8.25	− 9.9	3.9
France	16.96	12.88	16.68	−24.1	29.5
Italy	17.60	15.80	19.05	−10.2	20.6
Netherlands	7.80	6.42	9.05	−17.7	41.0
Belgium	8.54	5.04	7.07	−41.0	40.3
Luxembourg	0.23	0.12	0.16	−47.8	33.3
United Kingdom	3.57	3.70	7.30	3.6	97.3
Ireland	0.73	0.91	0.90	24.7	−1.1
Denmark	7.58	7.09	9.50	− 6.5	34.0
Greece	0.50	1.42	1.60	184.0	12.7
Total	72.32	61.32	79.56	−15.2	29.7

Source: Eurostat, *Coal Monthly Bulletin*

On the exporting side, the big winner in the market was Australia which because of its 15.3 million tonnes increase in exports overtook the United States and became the largest supplier to the international market. As shown in Table 3, Australia exports totaled 75.8 million tonnes in 1984, 1.8 million more than the United States. In actuality, if the exclusive U.S. to Canada non-seaborne trade is excluded from the statistics, Australia's advantage over the U.S. in supplying the international markets expands to 20.7 million tonnes (75.8 million tonnes seaborne trade for Australia versus 55.1 million tonnes of U.S. seaborne trade).

Other suppliers also benefiting from the record imports in 1984 include Poland (+8.0 million tonnes), South Africa (+7.5 million tonnes) and Canada (+8.2 million tonnes). The big loser in 1984 was the United Kingdom which, as a result of its labor difficulties, experienced a 3.9 million tonnes decline from the volume it exported in 1983.

Factors Influencing 1984 Trade

The primary driving force beind the record levels of trade in 1984 was the continuation of economic recovery with the accompanying increases in the production of electricity, steel, cement, etc. There were, however, other factors at work in influencing the market.

First, there was the threat of a labor strike in United States upon expiration of the United Mine Workers contract in September, 1984. While an eleventh hour agreement averted a strike, the potential of a supply disruption led many importers to increase their purchases in order to build stocks. This was particularly true for the Western European metallurgical segment of the market to which the U.S. is the largest supplier (43 percent of the Western Europe's total metallurgical coal imports in 1983 and 47 percent of the total in 1984).

Second, the National Union of Mineworkers strike in the U.K. resulted in the almost doubling of British coal imports in 1984. In addition, U.K. exports fell from 6.3 million tonnes in 1983 to 2.4 million tonnes in 1984. The replacement of this lost tonnage led to stronger growth for other suppliers. But, in addition, the loss of U.K. supplies simultaneous with the perceived threat of a U.S. disruption served to strengthen the consumer's stock building, particularly as the U.K. strike wore on throughout the year (part of which would be transhipped to the U.K.). In responding to the British situation the emphasis was on building thermal coal stocks which for all practical purposes is the only product shipped by the U.K.

Third, there was the bringing on line of new coal-burning facilities, the construction of which began following the first and second oil price shocks.

Finally, the strength of the U.S. dollar served to alter trading patterns and, to a lesser extent, increase coal demands. The impact of a strong dollar on the patterns of trade is rather straight forward, with non-U.S. dollar based suppliers gaining

TABLE 3

WORLD HARD COAL EXPORTS 1984 VERSUS 1983

(Million Metric Tons)

	Metallurgical Coal			Thermal Coal			Total		
	1983 (R)	1984 (P)	% Change	1983 (R)	1984 (P)	% Change	1983 (R)	1984 (P)	% Change
United States	45.5	51.7	13.6	25.1	22.2	−11.6	70.6	73.9	4.7
Australia	42.1	47.0	11.6	18.4	28.8	56.5	60.5	75.8	25.3
South Africa	3.0	5.0	66.7	26.2	31.7	21.0	29.2	36.7	25.7
Canada	14.5	22.1	7.4	2.5	3.1	24.0	17.0	25.2	48.2
West Germany	6.7	6.8	1.5	3.6	3.3	− 8.3	10.3	10.1	−1.9
United Kingdom	0.2	0.0	−100.0	6.1	2.4	−60.7	6.3	2.4	−61.9
Poland	9.7	10.5	8.2	25.4	32.6	28.3	35.1	43.1	22.8
USSR	7.7	7.2	−6.5	13.0	13.3	2.3	20.7	20.5	−1.0
PRC	3.3	2.9	−12.1	3.3	4.0	21.2	6.6	6.9	4.5
Others	2.6	2.6	0.0	7.1	7.5	5.6	9.7	10.1	4.1
Total	135.3	155.8	15.2	130.7	148.9	13.9	266.0	304.7	14.5
Seaborne*	112.0	131.6	17.5	87.6	103.6	18.3	199.6	235.2	17.8

(R) Revised
(P) Preliminary

relative to U.S. dollar sellers. But even the selling-in-U.S.-dollars suppliers were able to use the exchange rate to lower prices while maintaining their ability to pay their local currency costs.

The impact of exchange rates on market demands was more subtle. On the one hand, lower 1984 coal prices, produced in part by the conscious or unconscious recognition of U.S. dollar exchange rates when prices were negotiated, supported economic growth and increased coal demand. In addition, the exchange rate influence on reducing coal prices served to maintain the economic attractiveness of coal vis-a-vis oil. Unlike the coal price, U.S. dollar-based oil prices were being maintained by OPEC. Even though oil prices were cut in 1983, the effect on the international markets was offset by the increased value of the dollar in 1984. As a result, many consumers actually experienced an increase of the price of oil when they went to pay their oil bills with local currencies.

Outlook for 1985

As for coal trade in 1985, stable labor relations in the United States and the return of the British miner will eliminate the "strike-buying" component of imports experienced in 1984 and early 1985. Likewise, the working off of remaining excess inventories built in response to the 1984 labor situation will further dampen 1985 trade requirements. The majority of these effects will be felt in the metallurgical markets. This condition, along with lower rates of growth in pig iron and steel production following the steel industry's recovery from its recession-induced lows, will result in lower levels of metallurgical coal imports than experienced in 1984. The best estimate forecast is for metallurgical coal imports to decline to 148.8 million tonnes in 1985, a decrease of 7.6 million tonnes (4.9 percent) from 1984.

The thermal coal segment of the market will also be affected by the more stable relationship between labor and management. This effect, however, will be offset by the continuation of real economic growth and the addition of newly constructed coal-burning facilities in the European and Asian markets. Even though the real rate of economic growth will be lower in 1985 on a year-over-year basis (2.5-3.0 percent OECD growth in 1985 versus 4.5 percent in 1984) new facility additions and the continued consumption of coal at existing facilities is projected to produce a 9.1 million tonnes (6.1 percent) increase in thermal coal imports over 1984, reaching a total of 158.0 million tonnes for the year.

The net effect of the projected decline in metallurgical coal imports and the growth in the thermal coal market, is a very modest 1.5 million tonnes (0.5 percent) increase in total import requirements for 1985 to a level of 306.7 million tonnes. Total seaborne trade, however, is forecasted to increase by 3.8 percent (9.0 million tonnes) to a level of 244.2 million tonnes. The stronger growth in seaborne trade reflects the anticipated fall-off in Canadian imports from the United States, which are delivered via lake vessel.

In terms of the pattern of 1985 trade, the U.S. is forecasted to take the brunt of the fall-off in metallurgical coal trade, while simultaneously receiving less benefit from the projected increase in thermal coal trade. In total, Australia is projected to remain the largest supplier to the international markets, a position supported in part by the dramatically lower value of its dollar.

Chase's best estimate forecast of world coal trade is presented in Table 4 as the *medium* case. As in previous years, low and high forecasts indicating the range of uncertainty surrounding the key parameters influencing the market are also provided.

The *low* and *high* forecasts reflect the uncertainty surrounding the absolute size of existing inventory and consumer motivation in drawing them down. Also recognized in the range are the uncertainties concerning economic growth and the production of steel, electricity, cement, etc., as well as the uncertainty surrounding the speed of recovery of U.K. coal production.

Vincent J. Calarco, Jr.
Vice President & Coal Economist

TABLE 4
WORLD HARD COAL TRADE FORECAST
(Million Metric Tons)

	Metallurgical				Thermal				Total			
	1984	1985			1984	1985			1984	1985		
	(P)	Low	Med.	High	(P)	Low	Med.	High	(P)	Low	Med.	High
Importers												
North America	7.0	5.4	5.4	6.0	12.7	9.8	10.3	11.5	19.7	15.2	15.7	17.5
Latin America	9.3	11.0	11.3	12.5	0.4	0.5	0.8	1.0	9.7	11.5	12.1	13.5
EEC	32.5	29.5	30.3	31.0	61.3	58.3	65.0	67.0	93.8	87.8	95.3	98.0
Other W. Europe	12.0	12.0	12.3	12.6	10.8	11.9	12.8	13.5	22.8	23.9	25.1	26.1
Eastern Europe	11.3	10.4	10.4	11.5	24.0	24.5	25.2	26.0	35.3	34.9	35.6	37.5
Japan	69.3	61.0	63.2	67.5	18.5	19.3	20.0	21.0	87.8	80.3	83.2	88.5
Other Asia	10.9	11.0	11.5	11.9	16.1	17.3	18.2	19.0	27.0	28.3	29.7	30.9
Others	3.5	3.5	3.8	4.0	5.1	5.1	5.7	6.2	8.6	8.6	9.5	10.2
Total	155.8	143.8	148.2	157.0	148.9	146.7	158.0	165.2	304.7	290.5	306.2	322.2
Exporters												
United States	51.7	45.5	46.2	51.4	22.2	17.5	19.5	23.3	73.9	63.0	65.7	74.7
Australia	47.0	44.0	45.4	46.5	28.8	29.5	30.8	32.0	75.8	73.5	76.2	78.5
South Africa	5.0	4.3	4.6	5.0	31.7	33.0	36.1	37.0	36.7	37.3	40.7	42.0
Canada	22.1	21.0	22.0	22.8	3.1	3.7	4.1	4.5	25.2	24.7	26.1	27.3
Poland	10.5	9.5	10.0	10.5	32.6	30.5	32.0	32.5	43.1	40.0	42.0	43.0
USSR	7.2	7.2	7.2	7.6	13.3	13.3	14.2	14.2	20.5	20.5	21.4	21.8
PRC	2.9	2.9	2.9	2.9	4.0	4.1	4.2	4.2	6.9	7.0	7.1	7.1
Others	9.4	9.4	9.9	10.3	13.2	15.1	17.1	17.5	22.6	24.5	27.0	27.8
Total	155.8	143.8	148.2	157.0	148.9	146.7	158.0	165.2	304.7	290.5	306.2	322.2
Seaborne	131.6	125.0	128.9	136.7	103.6	105.5	115.3	120.3	235.2	230.5	244.2	257.0

(P) Preliminary

GLOBAL SPECIALIZED INDUSTRIES

David F. Banks, Senior Vice President

•

GLOBAL MINING & METALS DIVISION

DIVISION EXECUTIVE

Edward D. Henderson, Jr., Vice President

•

TECHNICAL STAFF

William A. Mulligan, VP, Senior Technical Director
Coal: James M. Griffin, VP
Aluminum: Jeremy W. Johnson, VP
Coal Economist: Vincent J. Calarco, Jr., VP
Steel: Dr. Lindsay D. Norman, Jr.
Stefan Ponto, AA

UNITED STATES
Mining & Metals Division
1 Chase Manhattan Plaza – 3
New York, NY 10081
TELEX: ITT 420610 CMB UI

NON-FERROUS METALS
Clare E. Bruder, VP, Team Leader
Arthur F. Casavant, III, 2VP
Eric Van Heyst, 2VP
Helene Santo, 2VP
Loretta Fava, AA
Mary Leone, AA

STEEL
Eugene A. Berry, VP, Team Leader
Stephen C. Small, VP
Thomas C. Gardner, 2VP
Gregory C. Clapp, AT
Gary Kaneb, AT
Stephen R. Simon, AA

ALUMINUM
A. Neil Sweeny, VP, Team Leader
Peggy Peckham, VP
Efrain Figueroa, AA

COAL
Gus C. Heckman, VP – Team Leader
Michael R. Casouris, AT
Peter J. Foley, Jr., AT
Kenneth E. Johnson, AA

CUSTOMER SERVICE & OFFICE ADMINISTRATION
Patricia A. Furman, VP
Judith Amelin, AT

FINANCIAL MANAGEMENT
Katherine L. Patton, AT

AFRICA
CHASE MANHATTAN OVERSEAS CORP.
Rep. Off. POB 9606
P.O. Box 9606 Johannesburg 2000
Johannesburg, South Africa
TELEX: JHB-7774

Henry E. Coe, VP, Africa Coordinator
Simon Steward, Manager

KENYA, ZAMBIA, ZIMBABWE
CHASE MANHATTAN OVERSEAS CORP.
East Africa Regional Office
P.O. Box 57051 Kenyatta House
Nairobi, Kenya
TELEX: 22722 NAIROBI

Robert John Fairell, Regional Manager

SENEGAL
CHASE MANHATTAN OVERSEAS CORP.
4 Ave. Roume Angle Rue Carnot-BP 89
Dakar, Senegal
TELEX: 3309 CHASEN

Louis Dilo, Region Manager

ASIA-PACIFIC

AUSTRALIA
CHASE MANHATTAN REGIONAL OFFICE-Australasia
15th National Bank Hse. 500 Bourke St.
Melbourne 3000, Australia
TELEX: CJCHASNAT AA33950

Peter W. Mills, VP, Asia Pacific Coordinator

HONG KONG
CHASE MANHATTAN ASIA LTD.
G.P.O. 8292
12 Harcourt Road
Hong Kong, Hong Kong
TELEX: 83834 CHASE HX

Amy Braden, Associate Director

INDIA
CHASE MANHATTAN BANK, N.A.
Representative Office
New India Assurance Bldg. 87 M.G.RD.
Bombay 400-023, India
TELEX: 112715 CMBI IN

Sudheer Desai, VP Country Manager

INDONESIA
THE CHASE MANHATTAN BANK, N.A.
C.P.O. Box 311
Jalan Medan Merdeka Barat 6,
Jakarta, Indonesia
TELEX: 44281-44369 (Chase JKT)

Jeroen L. Zweerts, VP

JAPAN
THE CHASE MANHATTAN BANK, N.A.
CPO 383 Tokyo 100-91
1-3 Marunouchi 1-Chrome, Chiyoda-Ku
Tokyo 100, Japan
TELEX: 22294 CHAMANBK J22294

Hideya Katayama, VP

KOREA
THE CHASE MANHATTAN BANK, N.A.
C.P.O. Box 2249
50, 1-KA, Ulchiro, Choong-Ku
Seoul 100, Korea
TELEX: CHASBK K23249

N.S. Kang, VP

MALAYSIA
THE CHASE MANHATTAN BANK, N.A.
Wisma Stephens
88 Jalan Raja Chulan
Kuala Lumpur, 05-12 Malaysia
TELEX: MA 30224

Kok Yew Tang, VP

PAKISTAN
THE CHASE MANHATTAN BANK, N.A.
Shaheen Comm'l Complex
M.R. Kayani Road
Karachi, Pakistan

Raymond J. Walsh, VP

PHILIPPINES
THE CHASE MANHATTAN BANK, N.A.
OFFSHORE BANKING UNIT
18 Fl., Filinvest Financial Center
Paseo de Roxas, Makati, Manila
TELEX: RCA 22696 CMB PH

Augusto Nilo, VP

TAIWAN
THE CHASE MANHATTAN BANK, N.A.
72 Nanking East Road Section 2
Taipei, Tiawan
TELEX: 21823 CHAMANBK

Rodney Freed, VP

THAILAND
THE CHASE MANHATTAN BANK, N.A.
Siam Center 965 Rama I Road
Bangkok, Thailand
TELEX: CHAMANBK TH 2601

Virat Phairatshiboon, Country Corp. Manager
Charmnarn Wangtal, Assistant Manager

EUROPE

FRANCE
THE CHASE MANHATTAN S.A.
39 Rue Cambon
75001 Paris, France
TELEX: 210610 CHASB

James G. Murray, VP

GERMANY
CHASE BANK A.G. HEADQUARTERS
Frankfurt/Main
P.O. Box 4428 Taunusanlage 11
Frankfurt/Main, Germany 6000
TELEX: 411625 CHAS D

Martin J. Hecke, VP

GREECE
THE CHASE MANHATTAN BANK, N.A.
P.O. Box 5
3 Korai Street
Athens, Greece
TELEX: 216121/219758/219759/216395

Carlos J. Quijano, VP Country Manager

ITALY
THE CHASE MANHATTAN BANK, N.A.
P.O. Box 10285 PT EUR
00100 Rome, Italy
TELEX: 610501 CHASER I

Sergio de Chiara, VP, Country Manager
Michele Vitali, 2VP AM

NORWAY
CHASE MANHATTAN BANK (NORWAY) S.A.
Tordenskjoldsgaten 3,
0160 Oslo 1, Norway

William N. Van Wagner, VP, Country Manager

SWEDEN
CHASE MANHATTAN OVERSEAS CORP.
Biblioteksgaten 11
Stockholm, Sweden 11146
TELEX: 12343 CHAMAN S

Gunnar M. Carlsson, VP

TURKEY
THE CHASE MANHATTAN BANK, N.A.
Stad Man, Kat 5
Buyukdere Caddesi 85,
Mecidiyekoy, Istanbul, Turkey
TELEX: 26625 CMB TR

Peter J. Nice, VP Country Manager

UNITED KINGDOM
THE CHASE MANHATTAN BANK, N.A.
P.O. Box 440
Woolgate House, Coleman Street
London EC2P 2HD, England
TELEX: 8954681 CHAMANBANK LDN

John T.S. Ward, VP

CHASE MANHATTAN LTD.
International Capital Markets
P.O. Box 16
Woolgate House, Coleman Street
London EC2P 002HD, England
TELEX: 886140 CMLTD G

Warren J. McLeland, Associate Director

WESTERN HEMISPHERE

ARGENTINA
THE CHASE MANHATTAN BANK, N.A.
25 De Mayo 130/140
Buenos Aires, Argentina
TELEX: 9138/9

Cesar A. Deymonnaz, 2VP

BRAZIL
CHASE/BANCO LAR
Praia De Botafogo 374
Rio De Janeiro, Brazil 22250
TELEX: (021) 31.647-31.692-BLAR-BR

Juan Carlos Del Rosario, VP
James Lynch

CANADA
CHASE MANHATTAN CANADA LIMITED
3605 Commerce Court West
P.O. Box 302-Commerce Ct. Postal Sta.
Toronto, Ontario, Canada M5L 1G1
TELEX: 06-23622

Clemens Wedel, VP
Gary R. Baumer, VP

CHILE
THE CHASE MANHATTAN BANK, N.A.
Mac Iver 325 Piso 6
Casilla De Correos
Santiago, Chile
TELEX: 1327 CHASE CZ

Alejandro G. Silva, 2VP

COLOMBIA
THE CHASE MANHATTAN BANK, N.A.
Apartado Aereo 16192
Edif Seguros Fenix CA7#32-33 Piso 29
Bogota, Colombia
TELEX: 44572 CHASE BOG

Manuel C. Pena-Morros, Country Manager

MEXICO
THE CHASE MANHATTAN BANK, N.A.
Apartado 37-477
300 Paseo De La Reforma Piso 7
Mexico 6D.F., Mexico
TELEX: 01771370 CHAMANBANK

Raul A. Chavez, VP
David Mills Smelser, AT

PERU
CHASE MANHATTAN OVERSEAS CORP.
Representative Office
Ricardo Rivera Navarrete 543
San Isidora, Lima, Peru
TELEX: 25690 PE CHAMANRU

Jorge E. Sosa, 2VP

VENEZUELA
THE CHASE MANHATTAN BANK, N.A.
Apartado 6559
Torre Phelps, Piso 26, Plaza Venezuela
Caracas 1010-A, Venezuela

Guillermo A. Montefusco, 2VP

The Coal Situation

VOLUME 5 — NO. 3
JUNE, 1985

AUTHOR'S NOTE

The following is a summary of a detailed examination of the outlook for the world coal markets which has been published in a Chase report entitled, **World Coal Outlook: A Reassessment.**

Information regarding the purchase of the complete report is contained in this issue of **The Coal Situation.**

WORLD COAL OUTLOOK 1985-2000

By the year 2000, annual world coal consumption is projected to reach almost 5.6 billion tonnes, an increase of close to 1.5 billion tonnes over the forecasted level of usage in 1985. As shown in Table 1, this growth is entirely the result of the increased use of coal for its thermal or heating properties.

Electric Power Generation

Possessing the economies of scale required for the cost effective use of coal in an environmentally acceptable manner, electric power generation is projected to remain the largest and strongest growing end-use application for coal over the remainder of the century, growing at a compound average rate of 2.7 percent per year. On a regional basis, coal-based power generation is forecasted to provide a growing share of world power requirements. The exceptions to this trend are in regions possessing a strong nuclear program as in Western Europe and the Centrally Planned Economies of Eastern Europe (CPE Europe), or in the Middle East where the relative share of power generation is influenced by the abundant resources of oil and natural gas in the Middle East. Despite the growing relative importance of nuclear power, coal requirements of Western and Eastern Europe will continue to expand.

Industrial and Other Thermal Coal Applications

Over the next 15 years, world consumption in industrial and other thermal applications is expected to increase at a compound average rate of 1.5 percent per year reaching an annual level of usage of almost 1.4 billion tonnes by the year 2000. This rather modest performance is the net result of:

(1) The stability and improvements in the price of oil and the increased availability of natural gas through the expansion of distribution systems leading to the long term displacement of the use of coal for space heating, water heating and/or cooking in the residential/commercial sector.

(2) Stable falling prices for oil and a price readjustment and increased availability of natural gas over the forecast period limits the ability of coal to capture a significant portion of the new-build and replacement market in the small-to-medium sized (less than 100,000 pounds of steam per hour of capacity) industrial boiler market.

(3) Although the large boiler (200,000 to 400,000 pounds of steam per hour of capacity) segment of the market will represent an area of growth for coal, the principal growth segment of the industrial market remains the cement industry. With this industry having essentially completed its conversion to coal, the growth in coal demands will be consistent with the growth in cement production.

TABLE 1
WORLD COAL COAL CONSUMPTION BY END USE 1983-2000
(Million Metric Tons)

		Forecast				1985-2000 Compound Growth Rates
	1983	1985	1990	1995	2000	%/Year
Electric Power	2,315.7	2,441.8	2,827.5	3,219.9	3,631.3	2.7
Industrial & Other Thermal	1,070.0	1,108.7	1,202.6	1,287.4	1,379.1	1.5
Sub-Total	3,358.7	3,550.5	4,030.0	4,507.3	5,010.4	2.3
Coking Coal	503.9	524.1	522.4	524.8	525.5	0.2
Synthetic Fuel Feedstock	28.5	39.1*	39.1*	39.1*	39.1*	—
Total	3,918.1	4,113.7	4,591.6	5,071.3	5,575.1	2.1

Total may not add due to independent rounding

*Held constant at existing levels

BEST AVAILABLE COPY

Coking Coal Demands

In contrast to the thermal coal market, world coking coal consumption, while recovering from the recession-plagued lows reached in 1981 and 1982, is forecasted to remain stagnant throughout the forecast period. This condition reflects the continued restructuring of world economies and industries (decreasing steel intensities*), improvement in blast furnace operations (decreasing coke rates), and steel industry investment in cost-saving technologies (electric furnace steel production and continuous casting).

World Coal Imports

Consistent with forecasted market demands, thermal coal accounts for the vast majority of the projected growth in international coal trade is shown in Table 2. From a level of 130.2 million tonnes in 1983, annual thermal coal imports are forecasted to increase steadily to reach 292.5 million tonnes by the year 2000.

In terms of areas of growth, Western Europe, Japan and Other Asia (Pacific Basin) are most significant for thermal coal trade. Together these three regions account for almost 80 percent of the projected growth of thermal coal imports between 1985 and 2000. The inclusion of forecasted growth in trade requirements in the Africa/Middle East region, almost exclusively represented by increased imports by Israel and North African countries, brings the market share up to 96 percent of the total forecasted increase in thermal coal imports. The remaining 4 percent of the growth represents increased imports by Latin America, the United States, and the CPE's.

As for coking coal trade, following a 15 million tonne recovery from the recession-affected level achieved in 1983 and a very modest increase in volume between 1985 and 1990, coking coal imports begin to stagnate in the 1990's. This result is the product of a forecasted stagnation of Western European and Japanese import requirements as decreasing steel production and improvement in technology reduce coke requirements in these areas. Declines registered in these areas are offset by a forecasted increase in pig iron production which leads to increased import requirements by the developing countries in Asia, Latin America and Northern Africa/Middle East. Coking coal imports by these expanding regions are forecasted to increase by a total of 19 million tonnes between 1985 and 2000.

*Steel consumption per 1975 $ of Gross Domestic Product (GDP)

Vincent J. Calarco, Jr.
Vice President & Coal Economist

TABLE 2

WORLD COAL IMPORTS BY MODE OF DELIVERY 1983-2000

(Million Metric Tons)

	1983	1985	1990	1995	2000	1985-2000 Compound Growth Rates %/Year
Coking Coal						
Seaborne	112.0	129.2	141.5	146.9	149.1	1.0
Non-Seaborne*	21.3	19.1	17.8	16.6	15.4	−1.4
Total	133.3	148.3	159.3	163.5	164.5	0.7
Thermal Coal						
Seaborne	87.6	116.0	166.5	203.2	254.2	5.4
Non-Seaborne*	42.6	41.9	41.3	38.2	38.3	−0.6
Total	130.2	157.9	207.8	241.4	292.5	4.2
Total Trade						
Seaborne	199.6	245.2	308.0	350.1	403.2	3.4
Non-Seaborne*	63.9	61.0	59.1	54.7	53.7	−0.9
Total	263.5	306.2	367.1	404.8	457.0	2.7

Total may not add due to independent rounding

*Overland, Lake and barge deliveries

CHASE

"World Coal Outlook: A Reassessment"

Order Now!

This study represents an update and revision to two earlier reports on the **World Coal Outlook to the Year 2000** which Chase released in October 1981 and March 1983. Like those earlier analyses, this report provides forecasts on a region basis for each major end-use application for coal, including electric power generation, industrial and other thermal applications, and coking coal. Also included are trade forecasts for thermal and coking coal.

Additionally in this year's analysis is an extended assessment of the performance of the world coal markets over a 20 year period covering 1963 through 1983. This examination of history adds the perspective as to where the industry is today and how it got there, thus providing the basis to better understand where it is heading. Further, this year's analysis includes sensitivity assessments of the key explanatory variables used in producing the forecasts. This allows the opportunity to formulate alternative projections.

TABLE OF CONTENTS

CHAPTER I. INTRODUCTION
CHAPTER II. WORLD COAL MARKET PERFORMANCE: 1963-73 VERSUS 1973-83
CHAPTER III. MARKET DEMAND FORECAST ASSUMPTIONS AND PARAMETERS
CHAPTER IV. MARKET DEMAND 1985-2000
CHAPTER V. WORLD COAL IMPORTS 1985-2000
CHAPTER VI. WORLD COAL EXPORTS 1985-2000
CHAPTER VII. SUMMARY, CONCLUSIONS AND MARKET UNCERTAINTIES

APPENDIX A Supply/Demand Regions and Country Membership
APPENDIX B Statistical Addendum to Chapter II
APPENDIX C Regional Supply/Demand Balances 1980-2000
APPENDIX D Total Coal Trade Importer/Exporter Trade Matrices 1980-2000
APPENDIX E Seaborne Coal Trade Importer/Exporter Trade Matrices 1980-2000

Price: One copy, $300 (U.S.). Each additional copy, $50 (U.S.). (Residents of New York, please add 8.25% New York sales tax.)

Order Blank

Name _____ Title _____

Company _____

Address _____

_____

Please send me_____copies of the "World Coal Outlook: A Reassessment"

For the Amount $_____
Check/M.O. enclosed ☐

Mail to: Ms. Linda McKenzie
Mining & Metals Division, 3rd floor
The Chase Manhattan Bank, N.A.
1 Chase Manhattan Plaza
New York, N.Y. 10081

MAKE CHECKS PAYABLE TO CHASE MANHATTAN BANK

The Coal Situation

B1900-54

VOL. 5 – No. 4
SEPTEMBER, 1985

SENSITIVITY OF WORLD COAL MARKETS TO FALLING OIL PRICES

After reaching a peak of $34 to $35 per barrel in 1981, the world average crude oil price has declined to approximately $27 to $28 per barrel in the first half of 1985. This has been a remarkably small decline given the extent of the oil supply/demand imbalance that has developed because of reduced demands and increased productive capabilities.

Since 1981, the world oil markets would have experienced a much sharper decline in price if not for the implementation of production quotas by OPEC. Under the production sharing system, which has Saudi Arabia in the pivotal role of residual supplier, it is estimated that unused OPEC productive capacity has reached over 11 million barrels per day. This quantity is equal to roughly 24 percent of the total daily average consumption of oil by the non-Communist world in 1984.

Although OPEC has been quite effective in containing price declines through production control, its ability or, more importantly, the willingness of its members to continue to do so is uncertain. Without the existence of OPEC and its control over output the potential for a very sharp decline in the price of oil increases greatly. This would obviously raise fears concerning the future outlook for the use of coal in thermal applications.

The purpose of this issue of *The Coal Situation* is to neither debate the outlook for OPEC nor to forecast the future direction of oil prices. Rather, the aim is to determine to what level the price of oil would have to fall in order to challenge the economic attractiveness of using coal in thermal applications (power generation, industrial steam raising, etc.).

Focusing on the use of coal for electric power generation, the analysis begins by determining the price of oil that is required to eliminate the economic attractiveness of the continued use of existing coal-fired facilities. It then proceeds to a review of the oil price that is required to make the total costs of a new oil-fired facility equal in present value to the total cost of building and operating a new coal-fired power plant. The analysis concludes with a qualitative assessment of the likely impact falling oil prices would have on the markets for coal over the long run.

Breakeven Oil Price for Existing Coal Users

Existing electric utility coal users can be divided into the following two categories:

(1) Utilities possessing dual fuel-fired or under utilized oil-fired facilities who can shift their energy source without interrupting operations or incurring significant capital expenditures.

(2) Utilities having primarily coal-fired facilities who would incur significant capital expenditures in order to switch to coal.

In general, the first category represents those utilities who emphasized or shifted to coal in response to the oil price shocks of 1973-74 and 1979-80. The second is composed of users for which coal was the economic choice even before the rapid escalation in the cost of alternative energy. For the most part, the consumers of imported coal (Europe, Asia, etc.) fall into the first category while domestic consumers (United States, Australia, etc.) fall into the second.

Of the two categories of users, the first is of most significance to the world coal industry. It represents that portion of the market which can quickly shift away from coal if oil prices warrant and the user is unconstrained politically.

If free to make an economic choice, the decision to switch fuels by those utilities falling in the first category would be based on a comparison of the variables cost of using coal and oil. Capital-related expenses would be treated as by-gones to be incurred whether the units are operated or not. If unconstrained, these consumers would tend to increase their use of oil and decrease their use of coal when the per unit of energy delivered price of oil falls below the sum of: (1) the per unit of energy delivered price of coal and (2) the differences, on a per unit of energy basis, of the non-fuel operating costs between the two fuels. Because these users already possess the capability to use oil or coal they can respond to short term events with relatively little concern over long-term conditions such as the future price paths of the two energy sources.

Table 1 and Table 2 show the latest data on the delivered price of coal to U.S. electric utilities and the average CIF price of thermal coal imported by the European Economic Community (EEC) and Japan. Also shown, in the last column of the tables, is the equivalent price of heavy fuel oil (HFO) that is required to match the effective per unit of energy (MMBtu) price of coal. In other words, on a national basis the delivered price of heavy fuel oil would have to have been $10.81 per barrel to match the U.S. national average effective price of coal.

TABLE 1

AVERAGE DELIVERED COAL PRICE TO:
U.S. ELECTRIC UTILITIES – MAY 1985

Census Region	Coal $/Ton	Coal $/MMBtu	Equivalent HFO Price* $/BBL
New England	53.83	2.03	13.46
Mid Atlantic	40.24	1.62	10.74
East North Central	40.08	1.84	12.20
West North Central	23.80	1.31	8.69
South Atlantic	47.14	1.90	12.20
East South Central	40.62	1.72	11.41
West South Central	25.99	1.59	10.54
Mountain	22.72	1.13	7.49
Pacific	27.33	1.67	11.07
National Average	35.12	1.63	10.81

*Coal prices adjusted for difference in unit heat rates (10,000Btu/Kwhr for coal vs. 9,500Btu/kwhr for oil) and assuming 6.3MMBtu per barrel of heavy fuel oil.

Source: National Coal Association, *Power Plant Coal Deliveries.*

TABLE 2

AVERAGE U.S. $ CIF IMPORTED THERMAL
COAL PRICES – 1ST QTR 1985

Importing Region/ Coal Source	Coal $/Ton	Coal $/MMBtu	Equivalent HFO Price* $/BBL
EEC			
USA	60.92	2.27	15.05
Australia	44.73	1.69	11.21
Poland	48.08	1.98	13.13
South Africa	34.98	1.47	9.75
Others	52.46	2.18	14.46
Weighted Average	46.41	1.88	12.47
Japan			
Canada	44.72	1.76	11.67
U.S.A.	55.89	2.08	13.79
Australia	45.82	1.73	11.47
USSR	38.68	1.63	10.81
South Africa	44.77	1.88	12.47
PRC	48.10	1.85	12.27
Others	48.25	1.85	12.27
Weighted Average	46.00	1.78	11.80

*Coal prices adjusted for difference in unit heat rates (10,000Btu/kwhr for coal vs. 9,500Btu/kwhr for oil) and assuming 6.3MMBtu per barrel of heavy fuel oil.

Source: IEA and Chase estimates.

In Europe and Japan, the price of heavy fuel oil would have had to average $12.47 per barrel and $11.80 per barrel to match the first quarter 1985 average CIF energy price of imported thermal coals. However, to these breakeven fuel prices must be added the differential in operating costs associated with generating electricity with the two fuels.

If it is assumed that the average non-fuel operating cost of a coal-fired unit is 4.0 mils per kilowatt-hour ($0.004 per Kwhr) higher than the cost of operating an oil unit the breakeven heavy fuel oil prices shown in Tables 1 and 2 increase by $2.65 per barrel. Table 3 shows the resulting breakeven price for heavy fuel oil which recognizes the differential in unit operating costs. Also included in the table is a range in crude oil prices which would produce the required breakeven price for heavy fuel oil.

The crude oil prices shown in Table 3 are a netback from the breakeven heavy fuel oil price assuming that fuel oil is priced at 90% and 110% of the price of crude. In general, heavy fuel oil prices in Europe and the United States have historically maintained a 0.9 to 1.0 ratio to the price of crude oil. The actual relationship is dependent upon the sulfur content of the oil being purchased and the pricing/taxing policies of the governments. In general, the higher sulfur content oils have a lower price ratio. In Japan, because of government pricing policies and environmental restrictions limiting usage to low sulfur oil, the ratio between the price of fuel oil consumed and the price of crude oil has been greater than one to one.

As shown in Table 3, for those utilities who presently possess the capability to increase their use of oil and who are able to use cheaper, higher sulfur fuel oil, crude oil price would have to fall below $16 per barrel for them to do so. In contrast, if restricted to low sulfur fuel oil, such as in Japan, a price of less than $12 per barrel is required for switching to occur.

TABLE 3

BREAKEVEN OIL PRICES FOR
EXISTING COAL-BURNING ELECTRIC UTILITIES
WITH OIL-BURNING CAPABILITIES

(1985 U.S. Dollars Per Barrel)

	Breakeven HFO Prices $/BBL	Crude Oil Prices Needed to Provide Breakeven HFO Prices 0.90*	1.10*
United States	13.46 (10.14-16.11)	14.96 (11.27-17.90)	12.24 (9.22-14.65)
EEC	15.12 (12.40-17.70)	16.80 (13.78-19.67)	13.75 (11.27-16.09)
Japan	14.45 (13.46-16.44)	16.06 (14.96-18.27)	13.14 (12.24-14.95)

( ) Range based on the delivered price of coal by consuming region (U.S.) or the source of imported coal (EEC and Japan).

* Ratio of the heavy fuel oil (HFO) price to the average crude oil price.

Regional Breakeven Oil Prices for New Power Plants

The calculation of a breakeven oil price for a utility deciding between adding a new coal-fired or a new oil-fired unit differs from that used for existing facilities. In this instance, capital expenditures and expectations of future energy prices over the life of the facility must be included.

Working in constant 1985 U.S. dollars, the estimation of the "breakdown" price of oil for new base-loaded power plants is determined as follows:

- Calculate the life of plant present value of the non-fuel cost element (i.e., capital and operating and maintenance expenses) of generating electricity for both coal-fired and oil-fired units.

- To the difference in the present value (coal minus oil) of the non-fuel cost of generation, add the present value of the cost of coal.
- Convert the total present value determined above to an annuity[1] which represents the levelized real cost of oil required for "breakeven" with the coal-fired facility.

The key assumptions used in determining the non-fuel generating costs (capital related costs and non-fuel operating expenses) for new coal-fired and new oil-fired facilities are shown in Table 4. The coal-fired unit includes the capital and operating expenses of a flue gas desulfurization (FGD) system. The oil-fired facility is assumed to be operated with low-sulfur (less the 1.0%) heavy fuel oil (LSHFO) in order to meet air quality standards.

The capital, operating costs and operating characteristics shown in Table 4 are generic in nature. Even though there exists regional variabilities, the difference in construction costs and operating expenses in new coal or oil-fired facilities are insignificant in their impact on the required breakeven oil price.

TABLE 4

ASSUMPTIONS FOR NEW BASE LOAD POWER PLANTS
(1985 U.S. Dollars)

	Coal	Oil
Capacity	2X600MW W. FGD	2X600MW W. LSHFO
In-service Date	1990	1990
Capital costs*$/Kw	1,250	850
Operating Costs–$/Kwhr	0.008	0.0025
Net Heat Rate–Btu/Kwhr	10,000	9,500
Capacity Factor–%	65	65
Operating Life–Yrs	30	30
Real Discount Rate–%	6.5	6.5

*Includes interest during construction

Table 5 shows the calculated breakeven real annuity crude oil price for new power plants based on the coal prices provided in Tables 1 and 2 escalating at a real rate of 0.0 percent per year, 0.5 percent per year, and 1.0 percent per year over the life of the facility. Since the capital costs and operating expenses of the oil-unit are based on the use of low sulfur fuel oil, a price ratio of 1:1 (fuel oil to crude oil) was used to determine the breakeven prices shown in the table.

As shown in Table 5, in order to eliminate the current advantage coal has over oil for the new power installations in the early 1990's, real crude oil prices over the life of the facilities would have to fall below $18.03 to $21.09 per barrel, depending upon consuming region and expected real escalation in the price of coal. While the international market (EEC and Japan) is more sensitive to falling oil prices, the magnitude of difference between it and the United States is not significant (less the 10%).

[1]The annuity represents a stream of equal annual payment over the life of the facility. The annuity is determined by dividing the present value by the sum of the real discount factors.

TABLE 5

REQUIRED BREAKEVEN CRUDE OIL PRICES* FOR NEW POWER PLANTS

(Constant 1985 U.S. Dollars per Barrel)

	0.0% Per Year Real Increase in Coal Prices	0.5% Per Year Real Increase in Coal Prices	1.0% Per Year Real Increase in Coal Prices
United States	18.03 (14.70-20.67)	18.62 (15.11-21.40)	19.25 (15.55-22.20)
EEC	19.69 (16.97-22.27)	20.36 (17.50-23.08)	21.09 (18.07-23.96)
Japan	19.02 (18.02-21.10)	19.65 (18.61-21.85)	20.36 (19.24-22.67)

( ) Range based on the delivered price of coal by consuming region (U.S.) or the source of imported coal (EEC and Japan).

*Based on a 1:1 ratio between the price of low sulfur (less than 1.0%) heavy fuel oil and crude oil.

Conclusions

In general, barring a collapse of OPEC's production sharing system and a subsequent price war, existing thermal coal markets are relatively secure. Even if a collapse were to occur, in order for the existing thermal coal market to be seriously eroded one would have to expect that 1) the cost structure in the production and transportation of coal would remain unchanged, and/or 2) coal market prices do not decline with a shift in demand as producers and shippers try to maintain markets and/or 3) the governments in the oil consuming countries do not initiate policies (taxation of oil consumption and/or imports) which absorb at least a portion of the decline in the price of oil as viewed by the consumer, and/or 4) oil prices do not rebound with an increased demand for oil following the decline in price.

As for new installations, owing to the higher capital and operating expenses of a coal-fired facility, a less dramatic decrease in the price of oil is needed to challenge the economic attractiveness of coal as an energy source. This obviously raises the level of uncertainty surrounding the long-term rate of growth of the market for coal. However, unlike the short-term decision making of an existing user, the decision maker for a new facility is required to form a judgment concerning the long-term outlook for the price of oil versus coal.

In short, while oil prices could fall below breakeven today, to challenge the addition of new coal-fired facility the decision maker must expect a future oil price path which produces of a lower present value (lower cost) than that expected for coal. While the rate of adding new coal units is undoubtedly being affected by the current oil price situation, the uncertainty surrounding prices over the long-run coupled with the question concerning government energy policy initiatives cited above tend to support continued growth in the use of coal.

In addition, it must be remembered that there are benefits to be derived from lower oil prices. After all, the income effect produced by lower oil prices would stimulate economic activity leading to increased production of cement, electricity, steel, etc. This would result in the increased use of existing facilities and, over time, the development of new operations. The net effect is an increase in total energy needs to the benefit of all energy forms including coal. Only a very dramatic, sustained decrease in the price of oil could challenge this conclusion.

Vincent J. Calarco, Jr.
Vice President – Coal Economist